BUDOWA

ELEKTROWNI WSKAWIN

STAT

BRIEF DESCRIPTION OF SKAWINA POWER STATION

Due to the growth of electrical energy requirements to supply the needs of our expanding industries, and the progressive increase of power consumption by both town and countryside, it has become essential to undertake a radical extension and developement of existing Power Stations in the Southern area, and also the building of new ones.

In accordance with this, it was decided by a Government resolution dated November 1952, to build a Power Station at Skawina of output 300 MW. Bearing in mind that most of the Power Station plant was to be supplied from U.S.S.R. the preliminary ouline as worked out by the Regional Board (Z.E.O.P.) was given in November 1953 to the Leningrad branch of the Power Station Construction Office (L.O.T.E.P.) for developement and detail design.

During 1953—1954 detailed geological and hydrological tests necessary for project work were carried out on the chosen site, and after the receipt of the technical project from L.O.T.E.P. in November 1954, permission was obtained from the relevant authorities for commencement of building, on 4. XII. 1954.

In October 1955 th assembly of the steel framework of the main building was begun, and in September 1956 the erection of ready-blocked boiler elements, for Boiler No. 1.

CHOICE OF SITE

In accordance with the provisions of the scheme and project design, the Power Station will be connected to the Silesia-Kraków Area section of the National Grid, and its special function will be to cover the energy needs of industrial establishments of the City of Kraków and the Kraków area, and the supply of excess energy to the National Grid.

The Power Station is situated at a small distance from a newly developed coal basin, and close to the river Wisła, and ist thus assured of its supply of both coal and water.

The Building terrain has a gentle profile, with inconsiderable variations from the level, thanks to which levelling work was reduced to a minimum. The soil consists of small-grained sands, with an admixture of clay fine gravel. Ground water is found at a level of about 8 m. and appeared only during the course of exceptionally deep excavations for the coal bunkers and pumping station.

The transmission of electrical energy will be by means of the 110 and 220 kV overhead lines.

COAL SUPPLY

The Power Station fuel will be low-grade coal from a newly-developed coal basin 25 Km. distant. During the interim period coal from the Jaworzno-Siersz mines will be used. The supply of coal from the mines will be by means of a normal-gauge railway, mainly by self-emptying waggons, marshalled in trains of 1000 ton load.

COAL — HANDLING PLANT

The loaded coal wagons are shunted to a covered discharge platform of length 144 m. positioned directly above underground coal bunkers of total capacity 2000 tons. From these bunkers the coal is taken through lengthwise gap-outlets by means of mobile grabbers onto two conveyor belts and then via reloading point No. 1. by first oblique conveyor to the crusher house. In this building are four crusher and sieve sets reducing the coal supplied to a granulation of 10—20 mm.

After passing through the crushers or sieves, the coal is raised by a second oblique conveyor to a further reloading point on the gallery above the overhead bunkers, at a level of 29,2 m, in the main building. After this the coal is carried on a belt running lengthwise along the boiler house above the overhead bunkers, and distributed by mobile discharge equipment.

There are two coal conveyor lines with an output of 390 tons/hour each.

In order to lay up the necessary coal reserves there is a coal store of capacity 100 thousand tons, which assures a coal reserve for a period of about three weeks with a Power Station output of 300 MW.

The store is equipped with a gate-type unloading crane of width between the rail of 63,5 m. and reloading capacity of 400 tons/hour, and with 2 self-propelled grab loaders, with a capacity of 50 tons/hour each.

WATER SUPPLY AND HANDLING

The operation of the Power Station is based on an open circulation of cooling water, and for this purpose the main cource of water is from the Wisła, drawn from a navigable canal about 1,5 km. away. Water from the point if drawing-off flows by gravitation in an open channel with reinforced banks to the inlet chamber in the central pumping station.

Inthe central pumping station are installed 6 centrifugal propellor-type pumps each of output 4,7 m^3/sec., supplying water for cooling purposes.

The cooling water after flowing through the condensers is led to one of two canals running along the southern wall of the main building in the direction of the river Skawinka.

The difference in water level in the outlet canal and in the bed of the river Skawinka is 7,5 m. approx, and this drop is exploited to operate a hydroelectric station of output 2000 kVA, the water turbine being of „Kaplan" type. In this way about 10 mln. kWh of energy will be gained annually and supplied to a local 15 kV grid.

There is also a possibility to lead back the heated water from the condensers to the inlet chamber, and by this means to get heating of the circulating water during the winter.

To replace water losses in the boiler circulation, it is intended to use water from tre river Skawinka, or from deep wells situated on the Power Station site.

This water is prepared by the chemical water-softening plant, which has apparatus for calcium-magnesium treatment, and sodium and hydrogen kation exchangers. It is also intended to install equipment to introduce phosphate solution directly into the boiler-feed system.

The boilers are fed directly with condensate obtained from the closed circulation, and losses are replaced with distillate from the evaporators.

The total output of the water treatment plant is 130 t/hour.

MAIN BUILDINGS

The main building of the Power Station has a cubic capacity of 343.000 m^3, and includes coal pulverising section, boiler house, degassing section and turbine house. The framework of the building is a steel structure weighing about 4000 tons. The outside walls are filled with large pre-fabricated plates made of cinder-concrete.

A special feature of the building is the placing of the coaling gallery, coal bunkers, and pulverised coal bunkers

and handling equipment on the outer wall of the boiler house, while the front of the boiler is on the degasser side.

On the northern side and parallel to the main building is the induced-draught fan housing, and a reinforced concrete chimney 120 m. high.

The electrostatic dust-precipitators are situated between the boiler house and the fan housing.

BOILER HOUSE

The amount of steam required for a Station output of 300 MW, is supplied by 7 fully-radiated type boilers with natural circulation of water and two steam drums, each boiler having an output of 230 t/h of steam at pressure 110 kg/cm^2 and superheated steam temperature of 510^0 C. It is arranged for boilers to be in motion, and one is kept in reserve.

The boilers are fired by pulverised coal, ground in individual ball-mills two for each boiler, with intermediate storage.

For the initial firing of the boilers and maintenance of a flame with small load, crude oil is fed to the boiler working burners and sprayed by means of steam.

Cleaning of the flue gases is by two-chambered electrostatic precipitators.

Hydraulic cinder and ash handling is provided, and both cinder and ash is carried by pipework to a dump outside the Power Station. It is intended to use the fine ash for tre prefabrication of building elements.

There are 7 feed pumps to feed the boilers, having each an output of 270 m^3/h with a pressure of 150 kg/cm^2 and electric drive, and 2 similar pumps driven from a turbine.

The boilers have fully automatic combustion, and pulverised coal and water supply.

Automatic and control gear is mounted either on the control panel shared by each two boilers or in special control boxes.

It is also intended to fit blocking between the boiler auxiliary installations, and automatic switch-on for the feed-pumps.

TURBINE HOUSE

To obtain the required output of 300 MW, 2 turbo-sets of 50 MW and 2 of 100 MW are installed. The turbines are of condensation type, with 3000 revs/min, inlet pressure 90 kg/cm^2, steam temperature of 500^0 C, outlet pressure to condenser 0,037 kg/cm^2, and with 5 bleeds without regulation for operation of regenerative units. The 50 MW turbines are of one-cylinder type and have each one divided-type condenser. The 100 MW turbines are of two-cylinder type and have each two condensers.

The alternators are of output 62,5 MVA, cos $\varnothing = 0,8$, 10,5 kV and 125 MVA, cos $\varnothing = 0,8$, 13,8 kV respectively. The alternators have closed circulation hydrogen cooling system.

The turbosets are installed lengthwise in the turbine house, at a level of 8 m, that is at the common operation level of the Power Station.

The turbine house is equipped with two 2-hook gate-type cranes of lifting capacity 100/20 tons each.

ELECTRICAL EQUIPMENT AND CONNECTIONS

The transmission of electrical energy from the 50 MW alternators is by an overhead bunch of cables, to the indoor 10,5 kV lay-out. This layout has two busbarsand is equipped with small oil circuit-breakers operated electromagnetically.

The 100 MW alternators will be connected in block form

with the corresponding transformers of ratio 13,8/110 kV for the No. 3 set, and 13,8/110/220 for the No. 4 set, and further with the busbars of the outdoor 110 and 220 kV layouts.

For the operation of Power Station auxiliaries it is planned to instal three 10,5/6 kV transformers of output 10 MVA each, and one reserve transformer of output 12,5 MVA and ratio 110/6 kV. A further two transformers of output 12,5 MVA and ratio 13,8/6 kV are tapped from the connections of blocks No. 3 and 4.

Station auxiliaries of working voltage 0,4/0,23 kV are supplied from transformers of output 0,56 MVA and ratio 6/0,4/0,23 kV.

For connecting the 10,5 and 110 kV systems, 2 inter-bus transformers are installed, of output 60 MVA each and ratio 10,5/110 kV.

Transmission of electrical energy to the 110 and 220 kV grids is by means of overhead lines equipped with air circuit breakers. The 19-field 110 kV layout has a divided two busbar system, with supplementary by-pass bus. The 220 kV layout has a similar arrangement but the busbar is not divided.

The control and direction of Station operation is from the central control room, where are the panels and boards for instruments for measuring, control and direction. On side boards is the protective relay equipment.

Remote control of the equipment is operated by direct current of voltage 220 V.

THERMAL EXPLOITATION

The Power Station buildings, the housing estate, and industrial concerns situated in the neighbourhood of the town of Skawina, will receive thermal energy from basic heat exchangers powered by steam from the third bleeds of each turbine, and from peak exchangers operating on steam from the reduction station. The heating medium will be water at temp. 150/70° C.

DEVELOPEMENT

It has now been decided by the Government representatives to develope the Power Station for an output of 500 MW.

For this purpose it is planned to instal a further two turbosets each of output 100 MW, but with a higher temp. of superheated steam than before (535° C) operating in block form each with two boilers of output 230 t/h each with pressure 110 kg/cm² and steam temp. 540° C.

The planned thermal consumption of the 100 MW turbosets type WK-106 will be 2190 kcal/kWh.

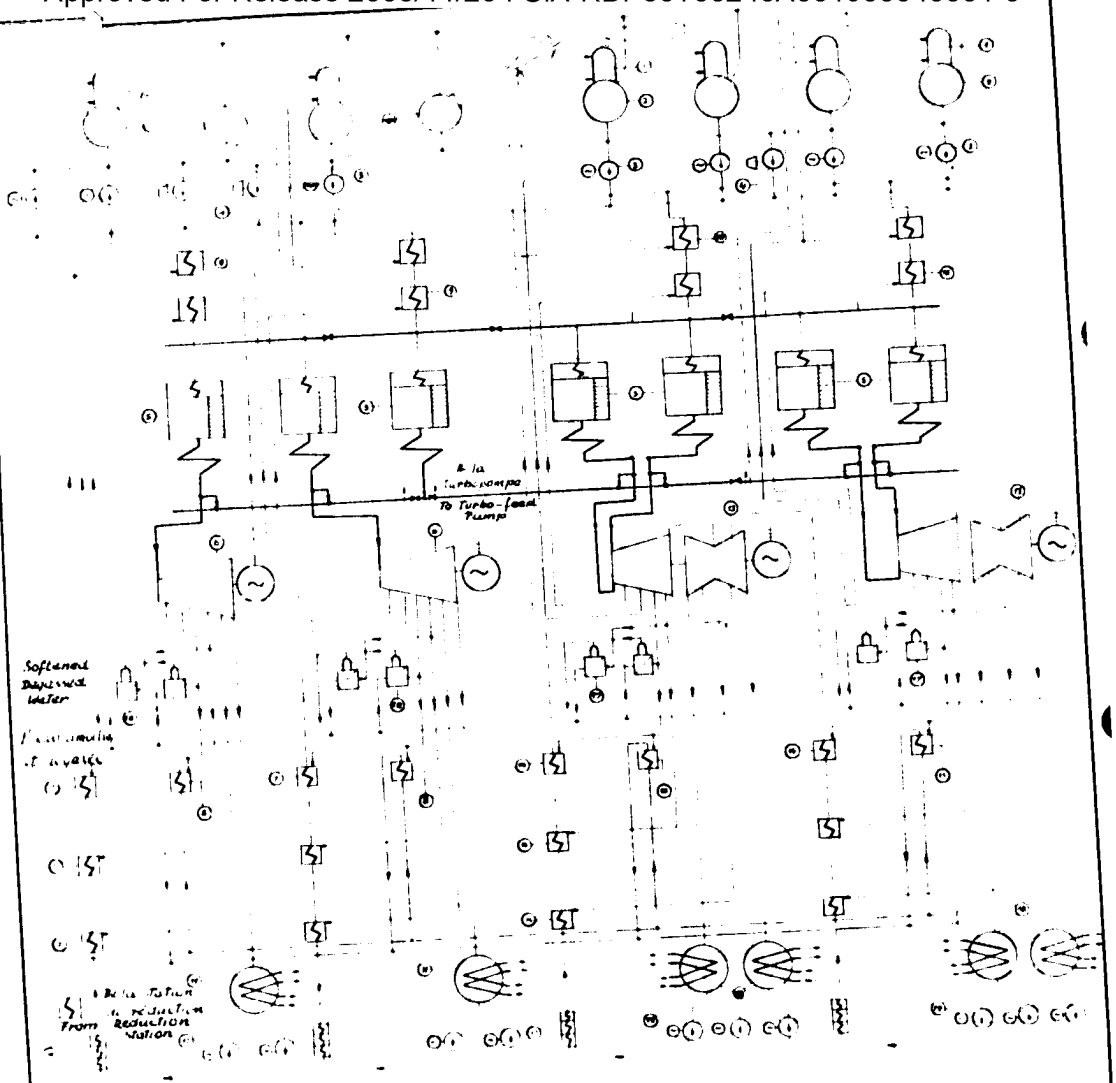
Transmission of power from the No. 5 alternator will be by a transformer of ratio 13,8/110/220 kV, and from No. 6 by a transformer of ratio 13,8/220 kV.

The above developement scheme requires special cooling equipment for the cooling water during the summer period, and eventually a changeover from open-flow system to open-recirculating system.

Coal and water handling plant, 110 and 220 kV electrical layouts, and auxiliary plants do not require extending to cover the increased output.

Further information is contained in the following drawings, which are attached:

1. General Plan
2. Simplified Thermal Scheme
3. Simplified Electrical Scheme
4. Main Building Plan
5. Section of the Main Building



Key to Equipment.

1. Degasser – 225 t/h – 6 kg/cm²
2. Feed Water Tank – 70 m³ · 6 kg/m²
3. Feed Pump – Elec. Drive 270 m³/h
   1500 m Water Guage
4. Feed Pump – Turbine Drive 270 m³/h
   1400 m Water Guage
5. Boiler TP-230 – 230 t/h · 110 kg/cm² – 510° C
6. Turbo – Alternator VK-50 – 50 MW – 90 kg/cm² – 500° C
7. L.P. Heater – VK-50
8. Base Heater for Heating Purposes – 5 Gcal/h
9. H.P. Heater – VK 50
10. Evaporator – 10 t/h
11. Condenser – VK-50
12. Condensate Pump – 175 m³/h
    125 m Water Gauge
13. Turbo-Alternator – VK-100
    90 kg/cm² – 500° C.
14. L.P. Heater – VK-100
15. Base Heater for Heating Purposes – 5 Gcal/h
16. H.P. Heater VK 100
17. Evaporators – 20 t/h
18. Condenser – VK 100
19. Condensate Pump – 175 m³/h
    125 m Water Gauge
20. Peak Heater for Heating Purposes 40 Gcal/h

Thermal Scheme.

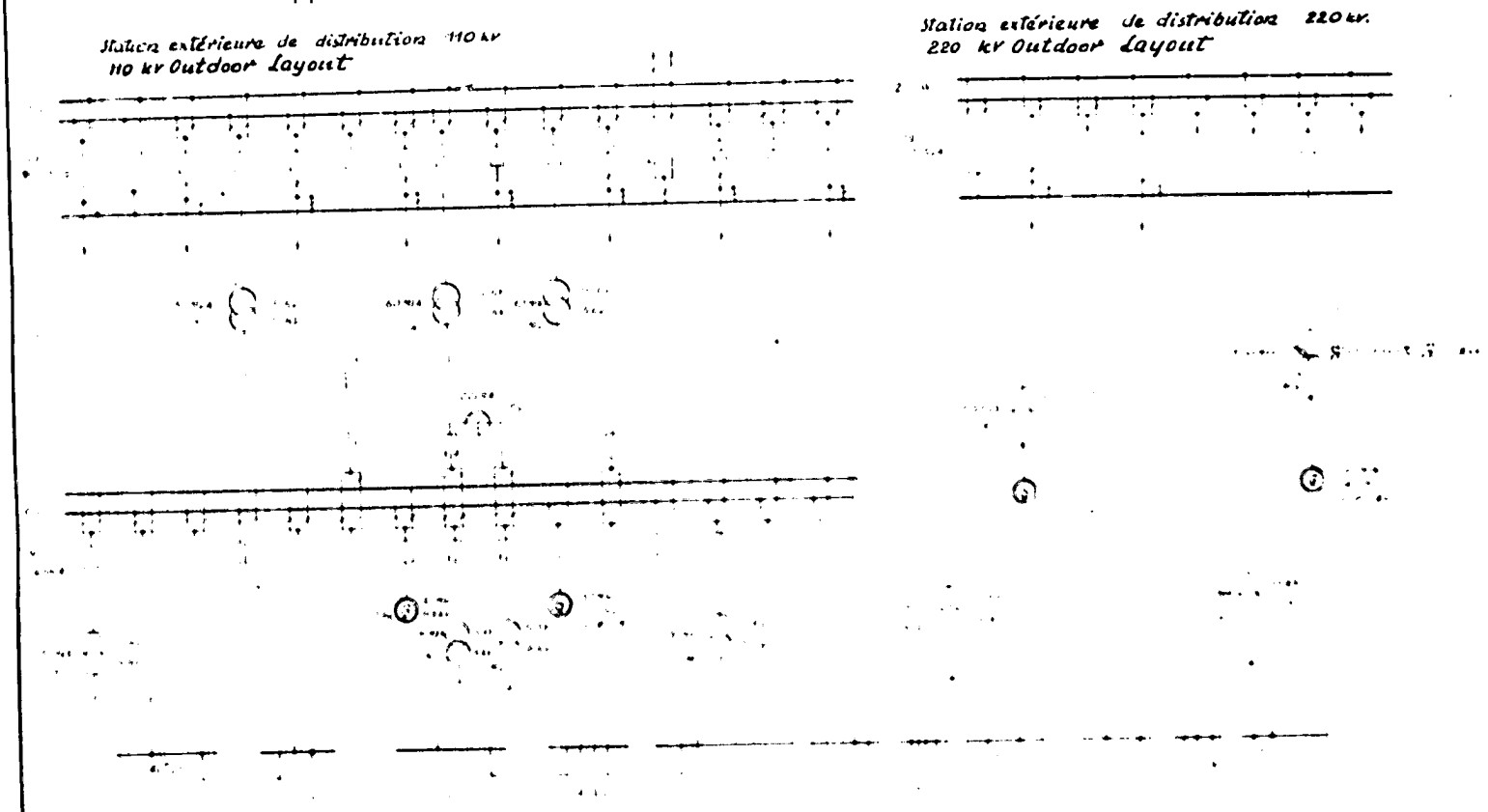
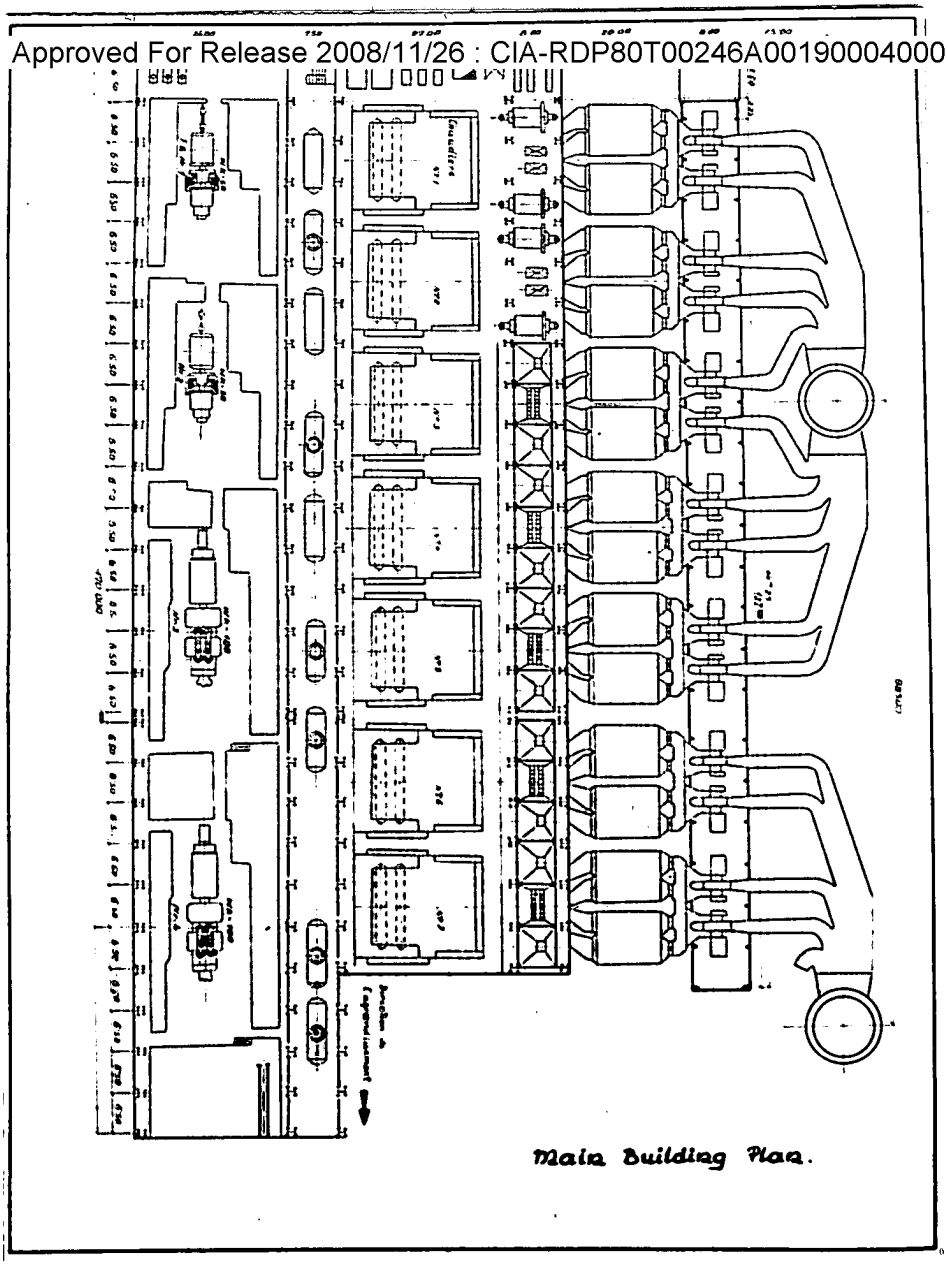


Schéma electrique.
Electrical Scheme.



Main Building Plan.

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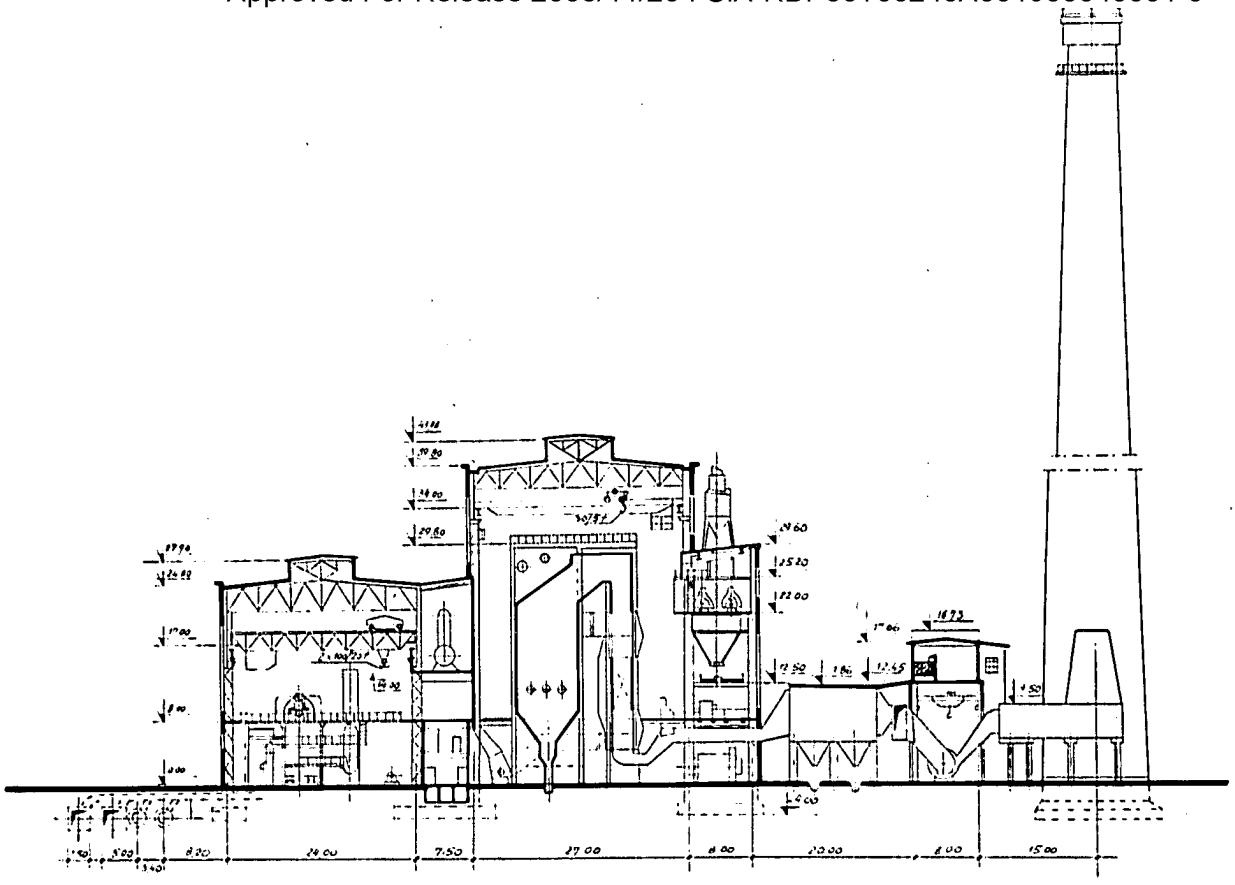
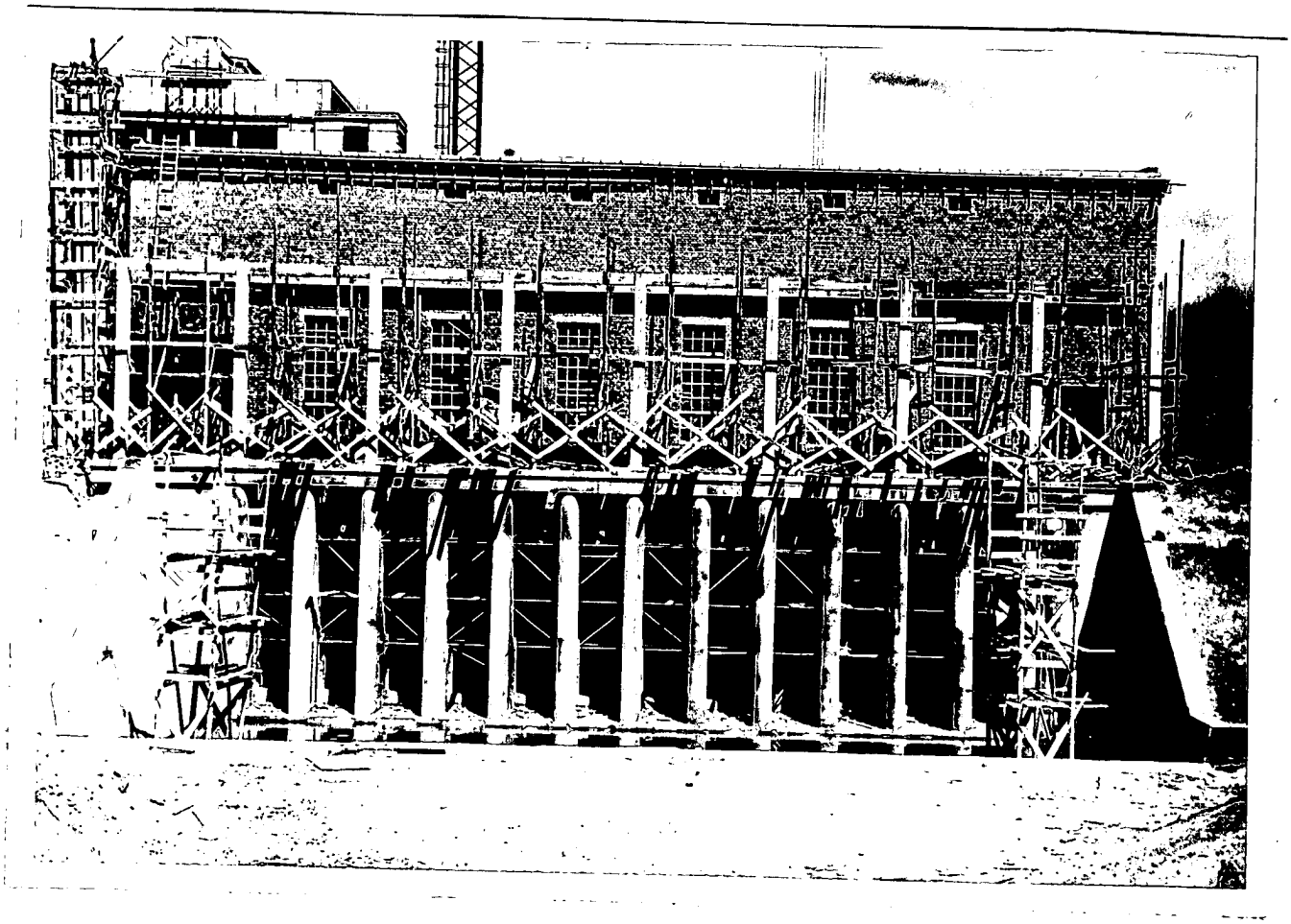
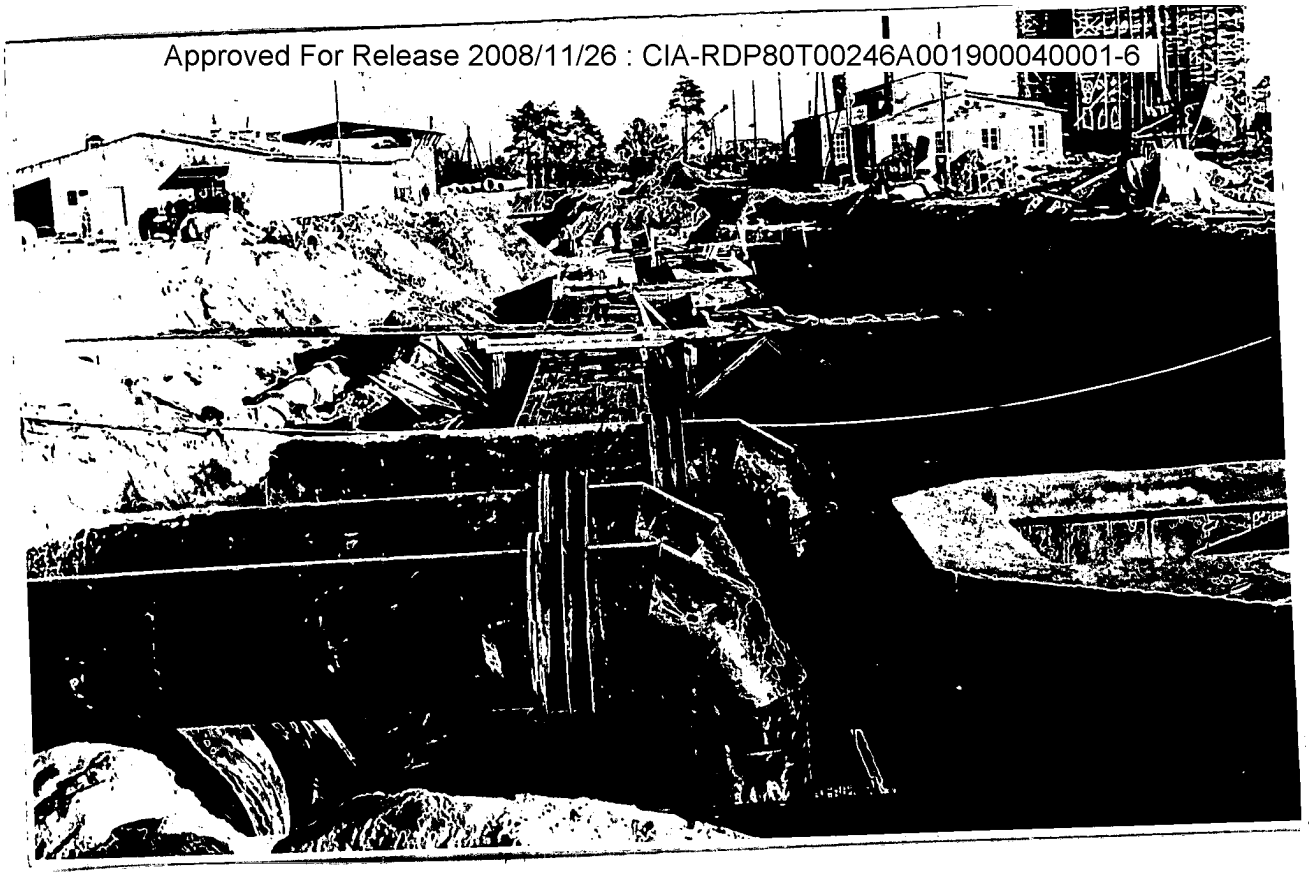


Section of the Main Building.





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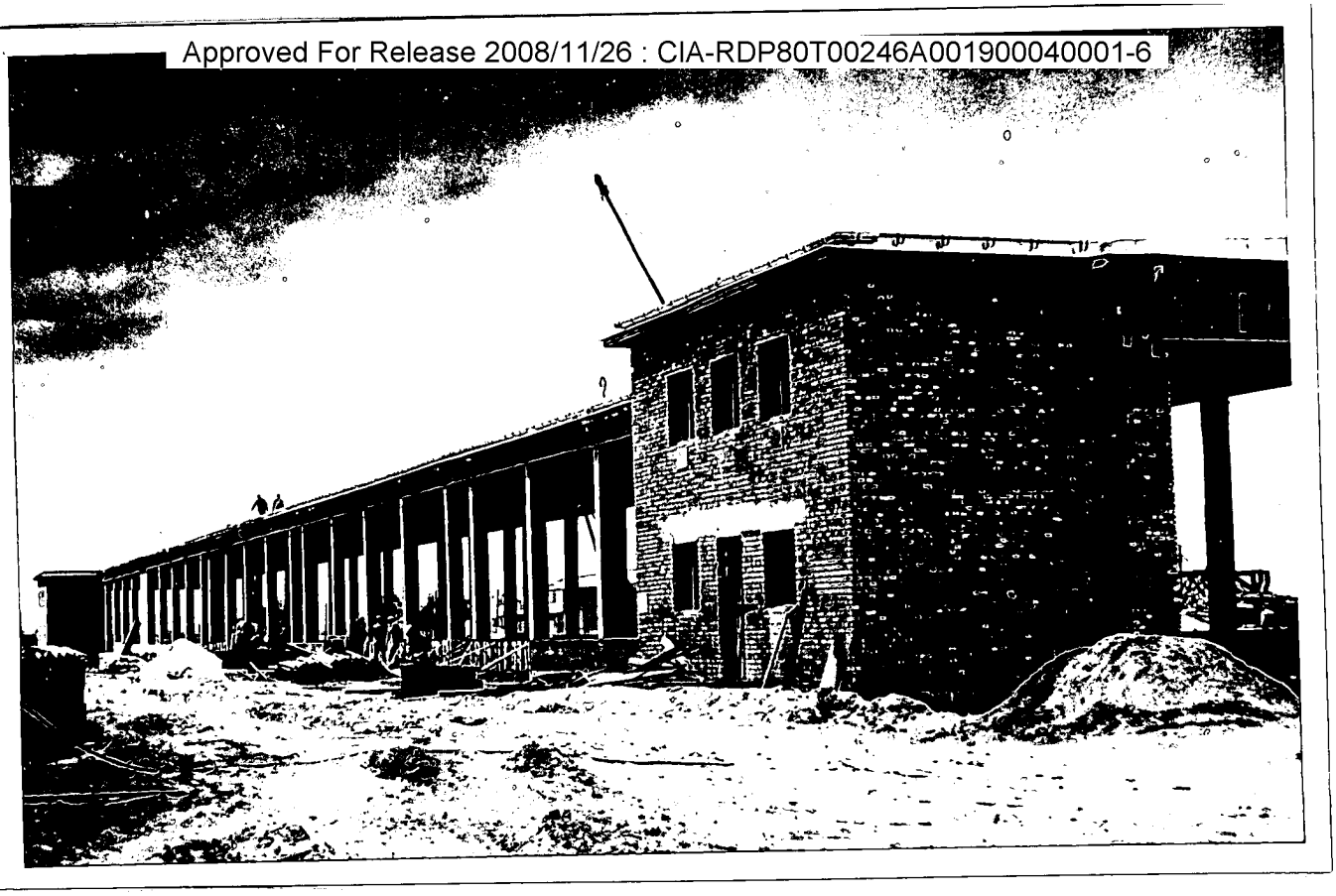

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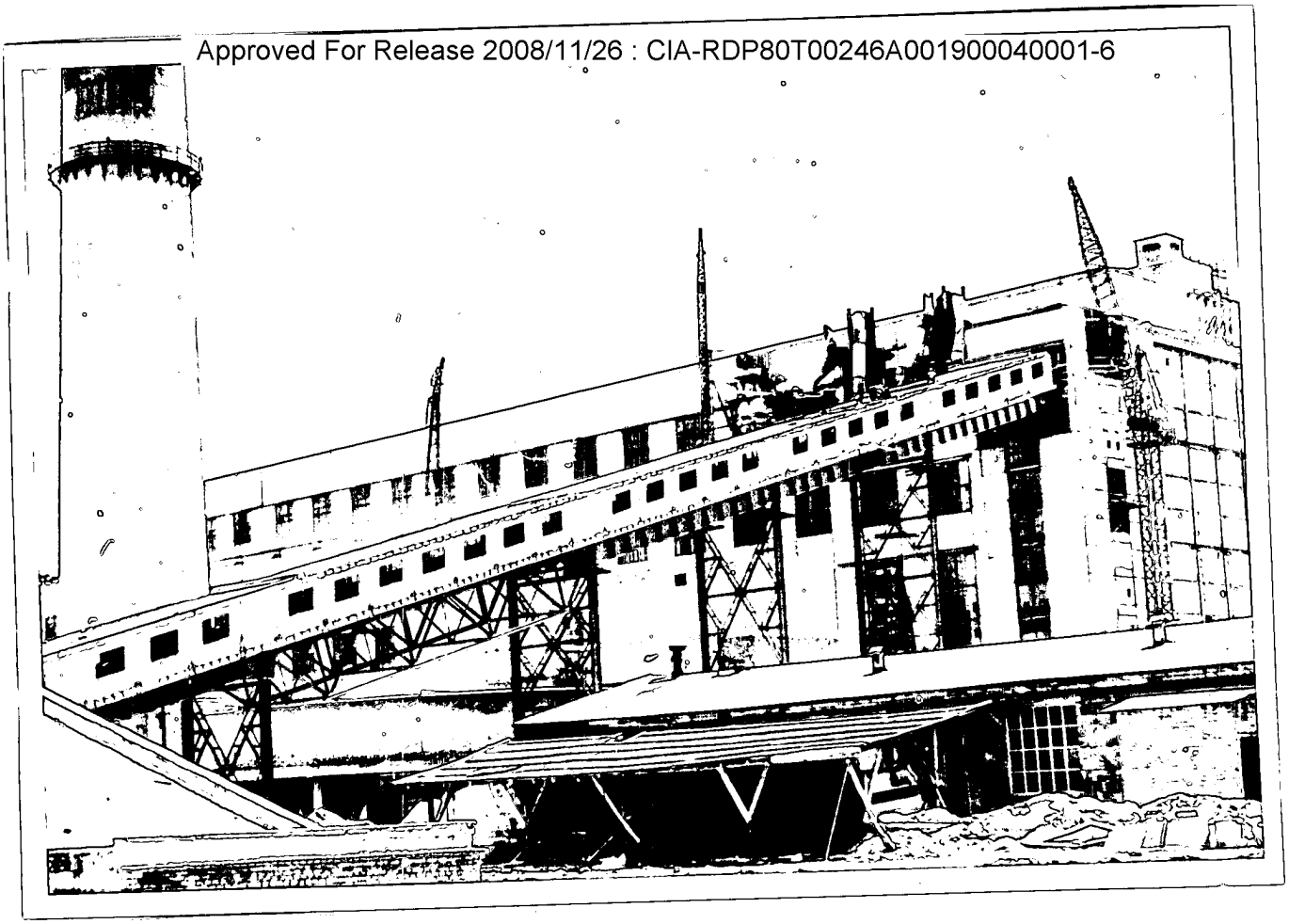

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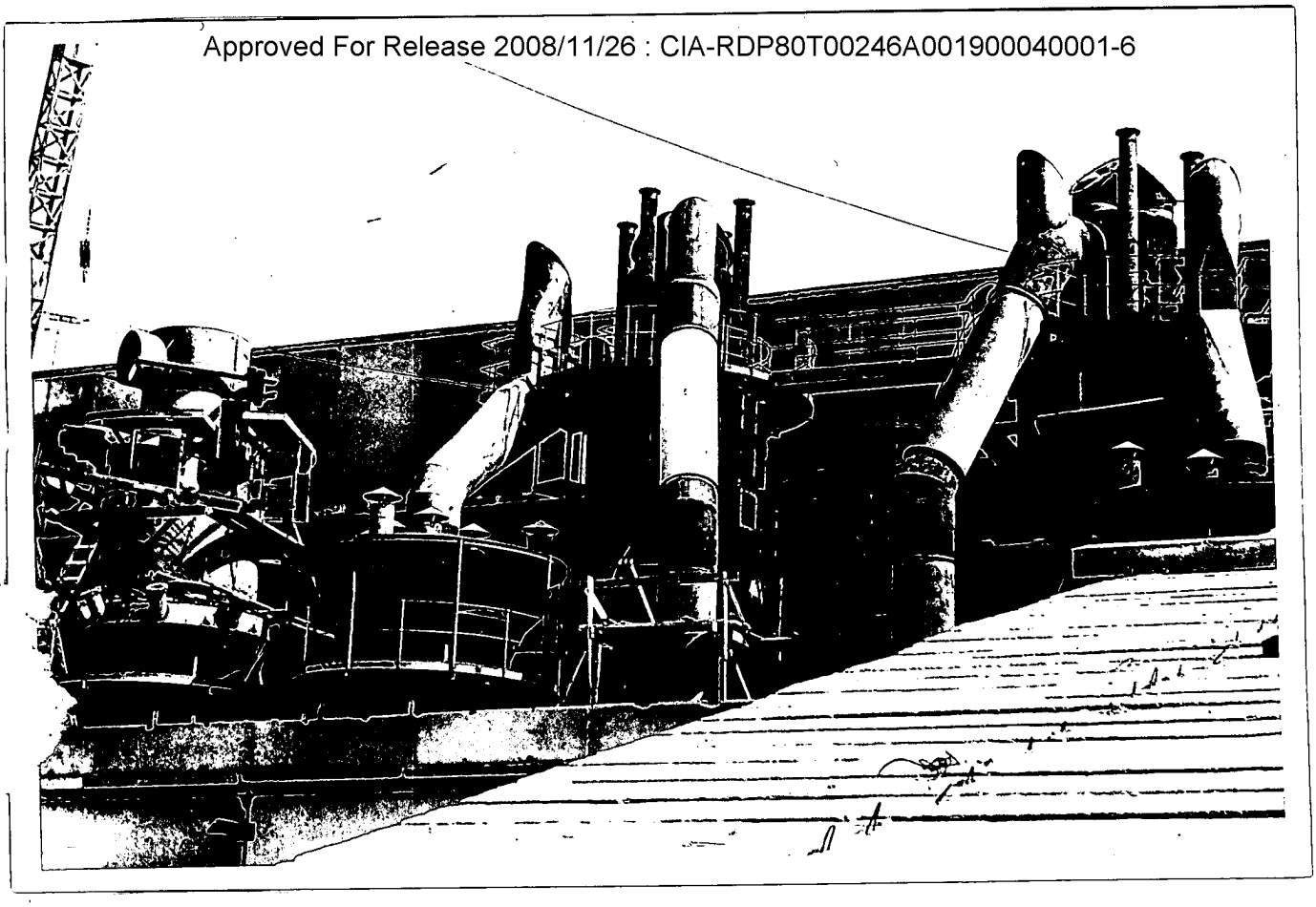

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